

Compositions for making barely wettable surfaces

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Abstract of EP1153987

A composition for the production of poorly wettable surfaces contains (i) finely-divided powder comprising particles with a hydrophobic surface and a porous structure characterized by a BET surface (DIN 66131) of at least 1 m²/g; and (ii) film-forming binder(s) with a surface tension of less than 50 mN/m, in a powder:binder wt. ratio of at least 1:4. Independent claims are also included for (a) a method for the production of poorly wettable surfaces by coating a conventional surface with the composition described; and (b) molded products with surfaces substantially consisting of such a composition.

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[0001] The available invention concerns a composition, in particular a coating means for the production of with difficulty wettable surfaces as well as a procedure for the production of such surfaces. The available invention concerns in particular the use of the coating means according to invention for the production of a surface with self cleaning effect.

[0002] Usual surfaces are usually moistened by liquids. The degree of the wetting is an interrelation between the Kohäsionskräften in the liquid and the adhesive powers between liquid and surface.

[0003] In many cases a wetting of a surface is unwanted by a liquid. For example the wetting of surfaces with water leads to the fact that on the surface water drops stay and evaporate, whereby the solids suspended loosened in water or stay as ugly arrears on the surface. This problem exists in particular with surfaces, the rain water is suspended.

[0004] By the wetting of a surface with water become frequently also its corrosion or an infestation with micro organisms as well as the vegetation with algae, lichens, Moosen, shells, etc. released.

[0005] With packing and storage vessels for liquid filling materials a small wettability of the inner surfaces is desired, thus when emptying only small liquid quantities in the packing and/or. stay in the storage vessel.

[0006] Also in the apparatus and equipment construction a small wettability of components, which come with liquids into contact, is desired. With a high wettability of the components the danger of an intensified formation of linings and deposits exists. In addition a increased wettability of usually increased flow resistances of liquids in pipings has as a consequence.

[0007] It is well-known to reduce the wettability of a surface for hydrophilic liquids by a hydrophobe coating of the surface. As coating materials thereby Polysiloxane and by-fluoridated polymers come, in particular the extremely hydrophobe polytetrafluoroethylene (teflon) into consideration. The adhesive powers between liquid and moistened surface are reduced by the coating.

[0008] In addition it proved as favorable to structure hydrophobe surfaces. Such surface textures exhibit usually regular or irregular collections or recesses within the range of 0,1 to 1000 μm. On the one hand the adhesion of the surface for polar liquids is still continued to reduce by the structuring such as water. In addition the structuring leads to a reduced adhesion of firm deposits such as dirt particles on the surface. Besides it showed up that with suitable structuring the dirt particle by moved water by the surface are rinsed off. This effect is called also self cleaning effect or plumb bob US effect (see Barthlott et al., to biology in our time, 28, No. 5, 314-322).

[0009] Thus describe for example the WHERE 96/04123 self-cleaning surfaces of articles, which possess an artificial surface texture, which collections and recesses exhibit, whereby the structure is characterized by the distance between the collections and the height of the collections in particular. The production of the surfaces effected for example via applying teflon powder on one with adhesive treated surface or via impressing a structure on a thermoplastic ductile hydrophobes material. From US 3.354.022 similar surfaces are well-known. The production of the surface takes place

▲ top also here either via impressing a structure or via applying hydrophoben particles, for example wax particles, on a hydrophobe surface. In addition a surface is described, glass dust in a wax matrix contains.

[0010] From the EP 933,388 a procedure for the production of structured surfaces with hydrophoben characteristics is well-known, with which one manufactures first a female form by optical lithography, coins/shapes afterwards with this form a plastic foil and the plastic foil with fluorine alkyl silanes hydrophobiert.

[0011] The EP-A 909,747 describes a procedure for the production of a self cleaning characteristic on ceramic(s) bodies such as roofing tiles, with which one applies a dispersion of clay/tone particles in an organic silicone resin solution on the ceramic(s) body and which coating hardens.

[0012] From the JP 7328532-A a coating process is well-known, with which one applies purify-hasty particles with a hydrophoben surface on a damp lacquer and hardens this. Here water-repellent surfaces are received.

[0013] Those while stationary the technology described methods for the production of with difficulty wettable surfaces are either very complex or do not lead not to satisfying results. The production of a structured surface by embossing procedures is complex and can be used only with flat surfaces economically. Surfaces, with which a structuring is reached by subsequent applying of hydrophober particles, can be reproduced frequently badly or exhibit only a small mechanical stability. Besides also this procedure is very complex. In addition frequently fluorine-organic connections or fluorhaltige polymers are needed, which are ecologically precarious not only very expensively, but also.

[0014] The available invention is thus the basis the task to make a coating means available to the production of surfaces with small wettability with which in simple and reproducible way stable coatings with small wettability can be manufactured. This task solved in form of a coating means, which covers at least a porous powder with a high specific surface, which in addition hydrophob is, and at least a hydrophobes bonding agent for the Pulverteilchen, whereby the

weight ratio from hydrophobem powder amounts to to bonding agent at least 1:4.

[0015] Therefore the available invention concerns a composition, in particular in form of a coating means, containing for the production of with difficulty wettable surfaces,

- i) at least a purify-hasty powder, whose Pulverteilchen exhibit a hydrophobe surface and a porous structure, which m< by a praying surface (determines according to DIN 66131) of at least 1; 2> /g is characterized, and
- ii) at least film screen end a bonding agent, which < by a surface tension; 50 mN/m is characterized, whereby the weight ratio from powder amounts to to bonding agent at least 1:4.

[0016] The compositions know z. B. in simple way on surfaces to be applied. Sie verringern nahezu vollständig?? Benetzbarkeit der Oberfläche und erzeugen auf diesen Oberflächen einen Selbstreinigungseffekt? In addition it was found that the compositions according to invention can be converted to molded articles, which exhibit a with difficulty wettable surface. Therefore the available invention concerns also a procedure for the production of with difficulty wettable surfaces, as well as with which one applies a composition according to invention on one surface which can be coated the use of the compositions for the production of surfaces with self cleaning effects.

[0017] For the characterisation of surfaces concerning its wettability the static contact angle of a liquid drop on a surface can be consulted. The static contact angle is defined as the angle, which is included by the mentioned surface and a tangent along the surface of the liquid drop in the range of the contact point of the liquid drop with the surface, whereby the contact angle is measured by the liquid drop. A contact angle of 0 therefore means complete wettability and no drop formation, while a contact angle of 180 DEG means complete Nichtbenetzbarkeit. The determination of the contact angle can be determined according to well-known methods, for example with the help of a microscope equipped with a goniometer (see also C. D. Bain et al., Angew. Chem. one. 101 (1989) 522-528 as well as A. Fount et al., color & lacquer 105 (1999) S. 96-104).

[0018] According to invention the surfaces treated with the compositions point usually for most diverse liquids, in particular for water, static contact angles ? to 120 DEG and in particular ? 140 DEG to (determines at ambient temperature). The contact angle for water and aqueous solutions amounts to usually at least 140 DEG. Frequently even contact angles are > 160 DEG, in particular with water, reaches. Contact angles above 160 DEG cannot be determined usually with sufficient accuracy. A contact angle above 160 DEG however usually corresponds with a perfect Unbenetzbarkeit to the surface.

[0019] Ein weiteres??für??Benetzbarkeit?einer Oberfläche ist?????????????als Kehrwert der Gewichtskraft FH definiert ist? welche erforderlich ist??einen Flüssigkeitstropfen??einer geneigten Oberfläche ablaufen zu lassen? The ? Repellent power? is computed for this on the basis the following formula:

$$FR = 1 \text{ DIVIDED } FH = 1 \text{ DIVIDED } \sin \alpha \cdot m \cdot g$$

[0020] Herein m stands for the mass of the liquid drop, g for gravitation acceleration and alpha for the smallest possible angle of inclination of the surface which can be examined against the horizontal, which is sufficient, to let the liquid drops of this surface run off.

[0021] By a film-forming bonding agent one understands here and in the following polymers and low-molecular substances, which form a firm film on a surface. The bonding agents serve z. B. to the adjustment of the Pulverteilchen on the surface of the substrate which can be coated or for the adjustment of the powder surfaces among themselves, if one uses the compositions as powder or makes of them a molded article.

[0022] For the characterisation its surface tension serves the Hydrophobie of the bonding agent. It can for example by measurement of the static contact angle of water at a smooth, with which bonding agents coated surface be determined can. Hydrophobe bonding agents are characterised by static contact angles for water of at least 90 DEG. It can also according to the method of the ?hanging drop? (counterpart drop: see S. Wu, ?polymer interface and Adhesion?, Marcel Decker Inc., New York 1982, S. 266-268) are determined. The indicated values for the surface tension of the bonding agents refer here and in the following to the values certain according to the ?method of the hanging drop?. Hydrophobe bonding agents in the sense of the invention point a surface tension < 50 mN/m up. The surface tension of commercial bonding agent polymers are partly in the literature indicated; see z. B. Wu et al. locomotive CIT. S. 88 FF. as well as S. Ellefson et al. J. To. Ceram. Soc. 21, 193, (1938); S. Wu, J. Colloid interface Sci. 31, 153, (1969), J. Physical one. Chem. one. 74, 632 (1970), J. Polym. Sci, C34, 19, (1971); R.J. Roe et al., J. Physical one. Chem. one. 72, 2013 (1968), J. Physical one. Chem. one. 71, 4190 (1967), J. Colloid interface Sci. 31, 228, (1969); J.F. Paday in ?Surface and Colloid Science (publisher E. Matijevic), Wiley, New York 1969, S. 101-149.

[0023] Such bonding agents, which < a surface energy, are preferential according to invention; 42 mN/m and < in particular; 37 mN/m exhibit. Usually it is sufficient, if the bonding agent exhibits a surface energy in particular ? 10 mN/m and ? 20 mN/m.

[0024] Usually it concerns with the bonding agents thermoplastic polymers, which are soluble in organic solvents. As bonding agents one can use also organic Prepolymere, which are interlaced by a thermal, oxidative or photochemical hardening procedure and so a firm coating with the powder to form.

[0025] Bonding agents are further fatty acids with more than 8 carbon atoms, ethylenisch fatty acids, and their ester with more-functional alcohols such as Glycerin, insatiated in particular, ethyl glycol, Propandiol, Sorbitol, glucose, Saccharose or Trimethylolpropan, whereby the fatty acids and their esters harden oxidative and rank thus among the class of the Prepolymere. Further natural of waxes are such as Bienenwachs, Carnaubawachs, Wollwachs, Candelillawachs as well as artificial of waxes such as Montansäurewachse, Montanesterwachse, amide waxes z as bonding agents. B. Distearoylethylendiamin, Fischer Tropsch waxes as well as waxlike polymers of the Ethylens and the propylene (polyethylene wax, polypropylene wax).

[0026] The kind of the bonding agent depends frequently on the desired application purpose and is for success according to invention rather of subordinated importance if the bonding agent hydrophob is sufficient.

[0027] A preferential class of hydrophober bonding agents are Homo and copolymers of hydrophoben, ethylenisch

insatiated monomers, which < in water a solubility; 1 g/l (with 25 DEG C) exhibit. Such monomers make usually at least 50 Gew. - % of the polymer used as bonding agents out.

[0028] Preferential ones hydrophobe monomers are selected under C2-C24-Olefinen, C5-C8-Cycloolefinen, Fluorolefinen, Fluorchlorolefinen, Vinylaromaten, Diolefinen such as butadiene, Isopren and Chlorbutadien, and of it different monoethylenisch insatiated monomers with at least a C2-C36-Alkylgruppe, with at least a C1-C22-Fluoralkylgruppe of the formula A, or with a Oligosiloxangruppe of the formula B:

?(A)? - (CH₂) A (CF₂) b-CF₃ where A for a whole number of 0 to 6 and b for a whole number from 1 to 16 stand;
 ?(B)? - (CH₂) C (O) e (SI (CH₃) 2O) D-r where for C for a whole number of 0 to 6 and D for a whole number from 2 to 10000 stand, e = 0 or 1 is and R stands for 3, alkyl with 1 - 18 C-atoms, or O-alkyl with 1 - for hydrogen, SI (CH₃) 18 C-atoms.

[0029] Examples of preferential hydrophobe monomers are C2-C24-Olefine, like ethyls, propylene, n-Buten, Isobuten, n-witches, n-Octen, Isoocten, n-Decen, Isotridecen, C5-C8-Cycloolefine such as Cyclopenten, Cyclopentadien, Cycloocten, vinylaromatics monomers, like styrene and alpha - methyl styrene, further fluorine and Fluorchlorolefine such as Vinylidenfluorid, chlorine tri fluorine ethyls, Tetrafluorethylen, Vinylester of linear or branched alkane dicarbonic acids with 2 to 36 carbon atoms, z. B. Vinyl acetate, Vinylpropionat, Vinyl n butyrat, Vinylisobutyrat, Vinylhexanoat, Vinyloctanoat, Vinylaurat and Vinylstearat, further esters of the acrylic acid and the Methacrylsäure with linear or branched C2-C36-Alkanolen, z. B. Ethyl (meth) acrylate, n-butyl (meth) acrylate, third. - Butyl (meth) acrylate, n-Hexyl (meth) acrylate, 2-Ethylhexyl (meth) acrylate, 2-Propylheptyl (meth) acrylate, Lauryl (meth) acrylate and Stearyl (meth) acrylate, further Vinyl and Allylether of C2-C36-Alkanolen, like n-Butylvinylether and Octadecylvinylether, fluorinated monomers of the formulas A1 to A4:

?(A1)? CH₂=CR' (CH₂) A (CF₂) b-CF₃,

?(A2)? CH₂=CR' o (CH₂) A (CF₂) b-CF₃,

?(A3)? CH₂=CR'- OC (o) - (CH₂) (CF₂) b-CF₃ ????

?(A4)? CH₂=CR' C (O) o (CH₂) A (CF₂) b-CF₃, where A and b have the meanings specified before and R' stands for hydrogen or methyl,

as well as Polysiloxangruppen containing monomers of the formula B1:

?(B1)? CH₂=CR' (CH₂) C (O) e (SI (CH₃) 2O) D-r where have C, D, e and R the meanings specified before and R' stands for hydrogen or methyl.

[0030] Typical bonding agent polymers of this type are polyethylene, polypropylene, Polyisobuten, Polychlortrifluorethylen, polytetrafluorethylene, Polyvinylacetat, Polyethylmethacrylat, Poly n butylmethacrylat, Polyisobutylmethacrylat, Poly third. - butylmethacrylat, Polyhexylmethacrylat, Poly (2-ethylhexylmethacrylat), Polyethylacrylat, Poly n.butylacrylat, Polyisobutylacrylat, Poly third. - butylacrylat, Poly (2-ethylhexylacrylat) as well as copolymers of the maleic acid with at least a hydrophoben monomer selected under C3-C36-Olefinen, C1-C36-Alkylvinylethern, the Vinylestern of aliphatic C1-C36-Carbonsäuren, the monomers A1, a2, A3, A4 and B1, in particular alternating copolymers of the maleic acid with these monomers, as well as the polymere-similar conversion products of these copolymers with C1-C36-Alkanolen, alcohols of the formulas:

?(A5)? HO (CH₂) A (CF₂) b-CF₃, or

?(B2)? HO (CH₂) C (O) e (SI (CH₃) 2O) D-r with before the meanings indicated for A to e and R; and/or with C1-C36-Alkylaminen, Di-C1-C36-Alkylaminen or amines of the formulas:

?(A6)? H2N (CH₂) A (CF₂) b-CF₃, or

?(B3)? (H2N (CH₂) C (O) e (SI (CH₃) 2O) D-r

?(A7)? HN [(CH₂) A (CF₂) b-CF₃] 2, (A7) or

?(B4)? HN [(CH₂) C (O) e (SI (CH₃) 2O) D-r] 2 with before the meanings indicated for A to e and R.

[0031] Suitable bonding agents are also Poly-C1-C4-alkylenoxide, like Polyoxymethylen, polypropylene oxide and Polybutylenoxid, Polytetrahydrofuren, further Polycaprolacton, polycarbonates, polyvinyl butyral, Polyvinylformal, as well as linear or branch out Polydialkylsiloxane such as Polydimethylsiloxan (Silikone).

[0032] Suitable bonding agents are further part-aromatic polyesters from aliphatic or aromatic dicarbonic acids and aliphatic and/or aromatic Diolen, e.g.:

Polyester, developed from aliphatic Dialkoholen with 2 to 18 C-atoms, z. B. Propandiol, Butandiol, Hexandiol, and dicarbonic acids with 3 to 18 C-atoms such as adipic acid and Decandicarbonsäure;

Polyester, developed from bisphenol A and the aforementioned dicarbonic acids with 3 to 18 C-atoms; as well as

Polyester, developed from Terephthalsäure, aliphatic Dialkoholen with 2 to 18 C-atoms and dicarbonic acids with 3 to 18 C-atoms.

[0033] The polyesters can be optionally with langkettigen mono alcohols with 4 to 24 C-atoms such as 2-Ethylhexanol or Octadecanol scheduled. Furthermore the polyesters with langkettigen mono carbonic acids with 4 to 24 C-atoms can such as z. B. Stearic acid scheduled its.

[0034] The weight-middle molecular weight of the bonding agent polymers can vary over a wide range and usually lies within the range of 1000 to 10 millions g/Mol and preferably within the range of 2500 to 6 millions, in particular to 5 millions g/Mol (viskosimetrisch determines). If the bonding agent polymer is a polyolefin and a in particular Polyisobuten, its weight-middle molecular weight preferably lies within the range of 30000 to 6 millions g/ Mol, or within the range of 500000 to 5 millions g/Mol. In case of the Polyoctadecylvinylethers the molecular weight lies preferably within the range of 2000 to 10000 g/Mol and in particular within the range of 2500 to 5000 g/Mol.

[0035] Typical ones photochemically and/or thermally interlacable bonding agents are polymers and/or. Oligomere with ethylenisch insatiated double bonds, as one uses it for the production of radiation-hardenable lacquers. Hierzu zählen beispielsweise flüssige Zbereitungen?Polyetheracrylaten? Polyesteracrylaten? Polyurethanacrylaten? Polyestern mit einkondensierten MaleinsäureanhydridEinheiten? Epoxidharze z. B. aromatic epoxy resins, whereby the Oligomere and/or. Polymere one for the improvement of their fluidity if necessary are solved in organic solvents and/or reactive solvents. By reactive solvents one understands low-molecular, ethylenisch insatiated liquids, which train the coating with

the ethylenisch insatiated polymers when interlacing. Radiation-hardenable bonding agents and these bonding agents containing preparing are sufficiently well-known the specialist, z. B. from P.K.T. Old ring (Hrsg.) ?Chemistry and Technology OF UV & EB Formulation for Coatings, Inks & Paints?, volume. 2, 1991, Sita Technology London, and commercially available, for example under the trade marks Laromer TM P084F, Laromer TM LR8819, Laromer TM PE55F, Laromer TM LR8861, BASF corporation, Ludwigshafen.

[0036] Particularly according to invention preferential bonding agents are C2-C6-Polyolefine, in particular Polyisobuten, ataktisches, ISO-tactical and syndiotaktisches polypropylene, polyethylene as well as Homo and copolymers of ethylenisch insatiated monomers with C4-C36-Alkylgruppen and in particular with C8-C22-Alkylgruppen and if necessary thereby copolymerisierbaren, ethylenisch insatiated Comonomeren, as well as C3-C4-Polyalkylenoxide. By this particularly preferentially are Homo and copolymers of C8-C36-Alkylvinylethern, e.g. Polyoctadecylvinylether.

[0037] According to invention the powders contained in the compositions are essentially characterized by their hydrophobe surface and their porous structure, which find their expression in a high specific surface. As specific surface the praying surface determined according to DIN 66131 is considered. According to invention the Pulverteilchen contained in the coating means point preferably a praying surface within the range of at least 5, in particular at least 10 and special preferentially to at least 20 m² /g up. In particular it lies within the range of 5 to 1000 m² /g, particularly preferentially within the range of 10 to 800 m² /g and completely particularly preferentially within the range of 20 to 500 m² /g up.

[0038] As Pulverteilchen both inorganic materials into consideration, which absorbed a hydrophobe surface out physically or chemistry-sorbed organic molecules with alkyl groups exhibit, and hydrophobe, organic polymer powders with high specific surface come into consideration.

[0039] In a preferential execution form the Pulverteilchen cover an oxidic carrier and layer present at the surface of the carrier and a hydrophobe. Of course the oxidic carrier has a porous structure. ??hydrophobe Schicht wird aus organischen? unpolaren Molekülen bzw? Groups of molecules in an educated manner, which on the surface of the carrier physically adsorbed or chemistry-sorbed are.

[0040] As oxidic carriers come for example alumina, titanium dioxide as well as silicon dioxide into consideration. Preferably it concerns with the oxidic carrier pyrogenes silicon dioxide (pyrogenes silicon dioxide: see Ullmann's Encyclopedia OF Industrial Chemistry, volume A23, S. 635 FF), which preferably m< a specific surface within the range of 50 to 400; 2> /g exhibits.

[0041] According to invention the powders with an oxidic substrate, contained in the compositions, usually exhibit a multiplicity of alkyl groups or (by) fluorine alkyl groups at their surface. These groups form the hydrophobe layer. Preferably the alkyl groups lie and/or. (By) fluorine alkyl groups in the form of (Perfluor) groups of alkyl silanes or (Perfluor) alkylsiloxangruppen z. B. in the form of (Poly) dimethylsiloxangruppen forwards, which are linked with the oxidic substrate, for example by physical reciprocal effect or by kovalente connections. One receives such Pulverteilchen usually by the fact that one the oxidic substrate with (Perfluor) a alkyl group halogen connection treated, which exhibits at least a reactive functional group, which with the OH-groups near the surface of the oxidic carrier particle a chemical reaction dies. Examples of such connections are Hexamethyldisilazan, Octyltrimethoxysilan, silicone oil, chlorine trimethyl silane or Dichlorodimethylsilan.

[0042] Porous Pulverteilchen, comprehensively oxidic carrier particles and on its surface hydrophobe layer present are well-known or can after for the production of hydrophobiertem pyrogenes silicon dioxide admitted methods to be manufactured. Hydrophobiertes pyrogenes silicon dioxide is for example under the designation Aerosil TM R 812S (company Degussa Hüls, Germany) in the trade available.

[0043] Examples of purify-hasty organic powders with hydrophober surface are purify-hasty polymer powders, z. B. Polytetrafluorethylene powder or C2-C4-Polyolefinpulver, for example after in the EP-A 761,696 described procedures available polypropylene and polyethylene powders. The purify-hasty organic Pulverteilchen exhibit usually diameters within the range of 0,05 μm to 100 μm, preferably within the range of 0,05 μm to 50 μm. The weight-middle particle size of the purify-hasty polymer powders (weight-middle Teilchendurchmessers of the Pulverteilchen) lies usually above 0,2 μm and below 100 μm and in particular within the range of 0,5 to 50 μm.

[0044] For the reaching according to invention wished of the effect of a small wettability it has as favorably proven, if in the compositions according to invention the weight ratio of powder i) to bonding agent ii) at least 1:4, in particular at least 1:3 and particularly preferentially at least 1:2, completely particularly preferentially at least 1:1,5 behaves. Preferably this weight ratio will not exceed a value of 100:1, in particular 50:1. Completely particularly preferentially the weight ratio of i lies) to ii) within the range of 1:1 to 5:1.

[0045] A preferential execution form of the invention concerns compositions in the form of coating means.

[0046] Coating means according to invention can in dry form, D. h. when powder preparation, which both the purify-hasty powder i) and the polymere bonding agent ii are covered, used).

[0047] In a preferential execution form one uses however the coating means in a form fluid at the processing temperature. The processing of the coating means can take place naturally both at ambient temperature and at temperatures underneath or above ambient temperature for example at temperatures within the range of 0 DEG C to 150 DEG C, depending upon kind of the preparation.

[0048] In the fluid form the coating means according to invention usually contain i beside the powder) and the bonding agent ii) if necessary an organic dilution or solvent, whereby such solvents are preferential, which loosen the polymere bonding agent or pour, not however the purify-hasty powder i). Thereby better training of the coating is reached.

[0049] Suitable solvents are volatile organic solvents, which evaporate after applying the coating, if necessary by warming up, and so the training of an even film bonding agent polymers permit. Examples of suitable solvents are Ketone, like acetone, Ethylmethylketon, volatile esters of acetic acid, like ethyl acetate, n-butyl acetate, cyclische Ether, like tetrahydrofurane as well as aliphatic and aromatic hydrocarbons, like turpentine oil, petroleum, gasoline, toluol and

xylene. Preferential ones organic solvents are the aforementioned aliphatic and aromatic hydrocarbons.

[0050] In the liquid formulations the solid content (total quantity from powder i) is appropriate and for polymere bonding agent ii), related to the total weight of the formulation) within the range of 0,5 to 80 Gew. - %. With conventional paints the solid content is frequently within the range of 10 to 50 Gew. - %. With sprayable lacquers it can be under it, also e.g. within the range of 0,5 to 10 Gew. - %.

[0051] The coating means according to invention can be formulated also as aerosols. They contain then beside the powder i) and the bonding agent ii) at least one propellant as well as if necessary also one that with the liquid formulations solvent specified. As propellants the for this usual substances come such as propane, butane, Dimethylether, CO₂, N₂O and their mixtures into consideration. The solid content of sprays lies usually in the for this usual ranges, for example within the range of 0,1 to 10 Gew. - %, whereby the solids apart from the components i) and ii) also firm of additives to cover can do. The remaining portions of the coating means formulated as aerosols are allotted to propulsion gases and if necessary solvents.

[0052] The coating means according to invention are applied for the production of the with difficulty wettable surface in well-known way on the substrates which can be coated.

[0053] In principle one can coat all conventional surfaces with the coating means according to invention. Examples of conventional surfaces are the surfaces of wood, metal, glass, plastic. Of course one can with the coating means according to invention also roughens and/or. porous surfaces, like concrete, gypsum, paper, fabric, for example textile fabrics for clothing, screens, tents, Markisen and for comparable applications, further leathers and also hair coat.

[0054] Applying the coating on the surface which can be coated (in the following also called substrate) takes place as a function of the arrangement of the coating means and the kind of the substrate in the order procedures usual in the lacquer technology. With coating means containing solvent and fluid the order takes place usually through capers, spraying, z. B. by means of Airbrush, dipping or rolling and following drying of the coating, whereby the solvent evaporates.

[0055] If one as bonding agent ii) thermally, oxidative or photochemically interlacable Prepolymer begins, then the coating means are fluid and can, if necessary frequently also without additive of solvents after diluting with a reactive solvent, after which mentioned above procedures are applied. The training of the actual coating takes place then via thermal, oxidative or photochemical hardening (cross-linking) the Präpolymere.

[0056] At powdered coating means one works in the usual procedures of the powder coating. With these procedures the powdered coating means in the desired quantity is applied to the substrate which can be coated and warmed up afterwards, whereby the thermoplastic, polymere bonding agent dissolves and forms for polymere film, which fixes the Pulverteilchen according to invention on the surface. Also one can apply the powdered coating means on a surface provided with a bonding emulsion. Here it comes likewise to the adjustment of the powdered composition on the surface which can be coated and in this way to the training of a heavywettable surface.

[0057] For the reaching of the desired effect one is preferably g/m² the coating means in a quantity of at least 0.01; 2>, in particular at least 0.1 g/m² and particularly at least 0.5 g/m² and preferably any more than 1000 do not g/m², related to the firm components in the coating means, on which apply surface which can be coated. Firm one of components are here essentially the components i) and ii). This corresponds to a weight per unit area of the coating of few 0.01, remaining after evaporating volatile components, g/m², in particular at least 0.1 g/m² and particularly at least 0.5 g/m². Frequently the coatings in quantities to 100 are g/m² on the surface which can be coated applied (related to firm of components), however one will apply also larger quantities of coating means with other application forms, for example with coatings in the form of Fassadenfarben or with the coating of concrete roofing tiles.

[0058] A further execution form concerns the use of the compositions according to invention for the production of molded articles with with difficulty wettable surfaces.

[0059] The production of the molded articles from the compositions according to invention can take place in actually well-known way in usual procedures for the production of molded articles from thermoplastic or duroplastischen plastics. One finds an overview in A. Franck, plastic manual, 4. Edition S. 147-205, bird book publishing house, pepering castle 1996: Johannaber, plastics machine leader, 3. Expenditure, houses Munich, Vienna 1992. Usually one becomes preferably for this a composition bloomable fluid at processing temperature or, which shows cold river, a usual Formgebungsverfahren, z. B. on use of thermoplastic bonding agents, a warm form, extruding and/or. Spritzgussoder a Blasformverfahren, subject. In the case of use of hardenable bonding agents come to the production of molded articles from thermosetting polymers and/or. Reaction resins in consideration, z. B. Reaction spraying gas, extruding, presses, in consideration. The compositions can be processed also in the form of powders, in particular on use of thermoplastic bonding agents, z. B. by presses and sinters.

[0060] For the production of molded articles according to invention it has regarding the firmness of the molded articles as proven, if the weight ratio of powder i) to bonding agent ii) a value of 10:1, preferably 5:1, in particular 4:1 and particularly preferentially 3:1 does not exceed itself favourably. For the surface properties according to invention it is preferentially by advantage, if the weight ratio powder i) to bonding agent ii) at least 1:3, in particular at least 1:2 and particularly at least 1:1,5 amounts to.

[0061] The molded articles according to invention exhibit at least one surface, which is composed of the compositions according to invention, D. h. the molded article can be completely from the compositions according to invention developed or only surface subranges exhibit, which are composed of the compositions according to invention, whereas the remaining molded article from other ranges is developed. Examples for this are molded articles, which are encased with the compositions according to invention like encased pipes or encased cables.

[0062] According to invention the substrates coated with the compositions are characterised by very small adhesive powers opposite liquids and solids. Liquids, in particular hydrophilic liquids, like water, aqueous solutions, dispersions and suspensions, polar organic liquids, in particular such, which are water soluble, z. B. C₁-C₄-Alkanole, glycols, Glycerin and their mixtures, in addition, melts of polar organic compounds, z. B. of carbohydrates and comparable

connections, beads of these coatings arrears-free off.

[0063] Besides according to invention the surfaces coated with the coating means are characterised by a self cleaning effect. Solids, in particular individual solids, can be removed from the surface by rinsing off with liquids such as water without cleaning agents. Surprisingly the individual solids can be removed also by compressed air very easily.

[0064] The same favourable characteristics as according to invention coated the surfaces exhibit also according to invention the molded articles made of the compositions. Besides the molded articles lose z surprisingly also during destruction of their surface. B. by roughening up or Zerkatzen, these characteristics not. This characteristic makes it possible to regenerate the favourable surface properties on aging of the surfaces.

[0065] Further flow resistance is reduced by liquids, in particular water and aqueous solutions, with the flow through pipes, capillary or nozzles, which are coated with the coatings according to invention.

[0066] Due to their characteristics the compositions according to invention can be used in various way.

[0067] Corrosion-susceptible materials, like concrete, reinforced concrete, wood or metal, can be protected by coating with the coating means according to invention effectively from corrosion.

[0068] The compositions according to invention are further suitable for the surface refinement of paper, cardboard or plastic foils.

[0069] Electrical devices, which are exposed to the weather and anschmutzen under climatic conditions, like high voltage-prominent overhead lines, tension shaping devices, insulators, parabolic antennas, etc., and which suffer achievement losses in dirty or damp condition, one can treat with the compositions according to invention. Thereby the Anschmutzen is reduced and an achievement loss is too avoided.

[0070] The compositions according to invention are suitable further for the protection from contamination in particular from surfaces, which are exposed to the weather, for example from roofs, fronts, windows, garden and balcony furniture, motor vehicles, traffic signs, Reklametafeln, solar plants, etc. Likewise conceivably an employment of the coating means according to invention is in the sanitary area, for example as coating for armatures, wet cells, bath tubs, swimming pools, winding and floor tiles, etc. The employment of the coating means prevents here not only the deposits of contamination from the water, but also the infestation and the growth of unwanted organisms, like micro organisms, algae, lichens and Moose.

[0071] Further one can use the compositions according to invention for the coating of components, which come with liquids into contact. Here in particular pipes, boiler, are tank, reactors, heat exchanger, evaporator, condensers, pumps, nozzles, atomizer, spray drier, crystallizers, racking plants, etc. to call. The equipment of these components with the compositions according to invention prevents a separating of firm components or decomposition products of the liquids. Thereby the education is decreased by linings, deposits, blockages, contamination on the surfaces of the plant parts, which come with the liquids into contact. In addition the surfaces according to invention in the components reduce, z. B. in pipes, the flow resistance of liquids. They reduce so the energy expenditure, which is necessary by the components for transport in particular very viscous liquids.

[0072] By equipment of the refreshing surfaces of refrigerators with the compositions according to invention the frequently arising freezing up can be reduced. The use of the coating means according to invention for the coating of hulls reduces the friction drag by the water and reduces so the fuel need. With airplanes one can reduce the danger of freezing by coating of the exterior surfaces with the coating means according to invention.

[0073] Packing for liquid filling materials, which are equipped with the compositions according to invention, can be emptied and made possible almost arrears-free thus on the one hand a better use of the filling material and to facilitate the recycling of the packing materials, since they are not contaminated by arrears of the filling material.

[0074] Storage vessels, whose inner surfaces are equipped with the compositions according to invention, can be emptied and be able more easily due to the self cleaning effect in simple way by rinsing out with water without the employment by Tensiden to be cleaned.

[0075] Fabrics, in particular textile fabrics, which are equipped with the compositions according to invention, are characterised by a high water impermeability and a small water absorption and are dirt-deflecting. By treatment with the means according to invention the fabric becomes proper water-rejecting. Dirt particle can be rinsed off easily with water, without it comes to a considerable water absorption. The compositions according to invention are suitable therefore as Wasser-und dirt-deflecting equipment for fabric, that for example for the production of clothing, tents, Markisen, tarpaulins, screens, for the lining of areas z. B. Kfz interiors, for the covering of seat faces, for example in the automotive range, to be used can.

[0076] Leather, that was treated with the compositions according to invention is suitable to the production of leather clothing and shoes with water and dirt-deflecting characteristics.

[0077] Within the range of the Kosmetik one knows the compositions according to invention as hair treatment means, z. B. in the form of hair sprays, use, if it a cosmetically compatible bonding agent i), z. B. for this usually the assigned polymers contain.

[0078] Construction units and/or Molded articles can be used in similar way.

[0079] The available examples are to clarify the invention, without limiting it however.

I. Analytics

1.1 general regulation for the determination of the Repellent power

[0080] The coated article which can be examined is installed on a measuring table, whose inclination can be stopped from 1 DEG to 90 DEG. Then one lets fall with the help of a Kanüle liquid drop on the sample, whereby the distance of the Kanüle from the sample surface amounts to 10 mm. The drops have a defined mass, which is determined by

previous weighing. By gradual lowering of the angle of inclination alpha the minimum angle of inclination is determined, with which the drops straight still abperlen. From the minimum angle of inclination alpha, which drop mass m and acceleration due to gravity g after specified the above form the Repellent power FR computed. The Repellent power is < in (milli Newton); - 1> indicated and a quantitative measure for the ability of a surface is liquid drop arrears-free abperlen to leave.

1.2 determination of the contact angle:

[0081] The determination of the contact angle took place with equipment type G1 of the companies Krüss GmbH. For this with the help of a Edelstahlkanüle with an inside diameter by 0,5 mm a drop distilled water was brought on the surface which can be examined. Then with the help of a goniometer of the contact angles between water drops and surface optically one determined. With very hydrophoben surfaces, how they are the subject of the available invention, the water drop does not stick to no more to the surface practically. With the withdrawal from the Edelstahlkanüle sticks the water drop then so long to the Kanüle, until it drips off due to its weight. With such surfaces the contact angle cannot any longer accurately certainly, but > on; 160 DEG to be measured.

II manufacture examples:

Example 1: Coating means B1

[0082] 10.73 g Polyoctadecylvinylether with a molecular weight of approx. 3000 g/Mol (viskosimetrisch determined) was solved in 96,6 g petroleum gasoline (boiling range 60 to 80 DEG C). In this solution one dispersed 10.73 g of a commercial, hydrophobierten pyrogenen silicic acid with a praying surface of 220 under intensive agitating m< 2> /g (determines according to DIN 66131; Aerosil TM R812S).

[0083] The Polyoctadecylvinylether used in the examples has a surface tension of 27,7 mN/m, certainly at a melt according to the method of the hanging drop.

Example 2: Coating means B2

[0084] 2.73 g Polyisobuten with a weight-middle molecular weight of 4,7 millions g/Mol (viskosimetrisch determined) in 113 g tetrahydrofurane were solved. In this solution one dispersed 6.37 g of a commercial, hydrophobierten pyrogenen silicic acid with a praying surface of 220 m< 2> /g (Aerosil TM R812S).

[0085] Polyisobuten has a surface tension of 33,6 mN/m (see. S. Wu, locomotive CIT, S. 88 FF).

Example 3: Production of one with the coating means B1 coated foil F1

[0086] The coating means B1 was laid on with a blade with a blade gap of 100 mu on a polyethylene terephthalate foil. One received the coating by evaporating the petroleum gasoline.

[0087] The Repellent power of the foil F1, intends for 10 gew. - %ige aqueous ethanol solution, amounted to 358 mN< - 1>. The drop mass amounted to here 5.44 mg.

Example 4: Production of one with B1 coated Glasflasche

[0088] A commercial Glasflasche from white glass was completely filled with the coating means B1. One left the coating means about one minute in the Glasflasche and poured it then. After evaporation of the petroleum gasoline one received one on its inside coated Glasflasche.

Example 5: Production of one with B2 coated plastic foil F2

[0089] The coating means B2 was applied in the way described in example 3 on a polyethylene terephthalate foil and the solvent evaporated.

[0090] The Repellent power of the foil F2, intends for 10 gew. - %ige aqueous ethanol solution, amounted to 154 mN< - 1>. The drop mass amounted to here 5.44 mg.

Example 6: Coating means B3

[0091] 5 g Polyoctadecylvinylether with a molecular weight of 3000 g/Mol (s.o.) were solved in 90 g petroleum gasoline (boiling range 60 to 80 DEG C). In this solution one dispersed 5 g of a commercial, hydrophobierten pyrogenen silicic acid with a praying surface of 220 m< 2> /g (Aerosil TM R812S).

Example 7: Coating means B4:

[0092] 1,5 g Polyisobuten with a molecular weight of 4.700.000 g/mol (viskosimetrisch determined) were solved in 50 g gasoline (boiling range 60-80 DEG C). In this solution 13,5 g polytetrafluoroethylene powders with a grain size by 1 mu m and a specific praying surface were m< of 8,01; 2> /g (manufacturer Aldrich) under intensive agitating disperses.

Example 8: Production of one with coating means B4 coated glass plate F3

[0093] The coating means B5 was laid on with a blade with a blade gap by 100 mu m on a glass plate. After evaporating the petroleum gasoline one receives a layer, which is not no more moistened by water.

[0094] The static contact angle of the coated glass plate F3 opposite water is > 160 DEG.

[0095] The Repellent power of the glass plate F3, intends for 10 gew. - %ige aqueous ethanol solution, amounted to 36 mN< - 1>. The drop mass amounted to here 5.44 mg.

Example 9: Coating means B4 (spraying lacquer):

[0096] 2.73 g Polyisobuten with a molecular weight of 4.700.000 g/mol (viskosimetrisch determined) were solved in 900,9 g gasoline (boiling range 60-80 DEG C). In this solution one dispersed 6.37 g of a commercial, hydrophobierten pyrogenen silicic acid with a praying surface of 220 m< 2> /g (Aerosil TM R812S).

Example 10: Production of one with coating means B5 coated wooden plate F4

[0097] The coating means B5 was applied with a air Brusch (type HY-MAX HP 10) on a wooden plate. After drying one receives a layer, which is not no more moistened by water.

[0098] The Repellent power of the wooden plate F4, intends for 10 gew. - %ige aqueous ethanol solution, amounted to 537 mN< - 1>. The drop mass amounted to here 5.44 mg.

Example 11: Coating means B6 (aerosol):

[0099] 2.73 g Polyisobuten with a molecular weight of 4.700.000 g/mol (viskosimetrisch determined) were solved in 900,9 g gasoline (boiling range 60-80 DEG C). In this solution one dispersed 6.37 g of a commercial, hydrophobierten pyrogenen silicic acid with a prying surface of 220 m< 2> /g (Aerosil TM R812S). 50 g?dieser????eine Spraydose gefüllt wurden? Then one pressed 21.4 g on propulsion gas.

Example 12: Production of one with coating means B6 coated glass plate F5

[0100] The coating means B6 was up-sprayed on a glass plate and 3 minutes was dried.

[0101] The Repellent power of the glass plate F5, intends for 10 gew. - %ige aqueous ethanol solution, amounted to 77 mN< - 1>. The drop mass amounted to here 5.44 mg.

Example 13: Coating means B7:

[0102] 1.5 g Polyisobuten with a molecular weight of 4.700.000 g/mol (viskosimetrisch determined) were solved in 78,8 g gasoline (boiling range 60-80 DEG C). In this solution one dispersed 13.5 g polypropylene powder with a particle size < 36 mu m and a prying surface of 5,3 m< 2> /g (manufactured after EP-A 761696).

Example 14: Production of one with coating means B7 coated glass plate F6

[0103] The coating means B7 was laid on with a blade with a blade gap by 150 mu m on a glass plate. After evaporating the petroleum gasoline one receives a layer, which is not no more moistened by water. The static contact angle opposite water be more than 160 DEG.

[0104] The Repellent power of the glass plate F6, intends for 10 gew. - %ige aqueous ethanol solution, amounted to 90 mN< - 1>. The drop mass amounted to here 5.44 mg.

Example 15: Coating means B8:

[0105] 1.5 g Polyisobuten with a molecular weight of 4.700.000 g/mol (viskosimetrisch determined) were solved in 48,6 g gasoline (boiling range 60-80 DEG C). In this solution one dispersed 6 g polypropylene powders with a particle size < 36 mu m and a prying surface of 5,3 m< 2> /g (manufactured after EP-A 761696).

Example 16: Production of one with coating means B8 coated glass plate F7

[0106] The coating means B8 was laid on with a blade with a blade gap by 150 mu m on a glass plate. After evaporating the petroleum gasoline one receives a layer, which is not no more moistened by water. The static contact angle opposite water be more than 160 DEG.

[0107] The Repellent power of the glass plate F7, intends for 10 gew. - %ige aqueous ethanol solution, amounted to 50 mN< - 1>. The drop mass amounted to here 5.44 mg.

Example 17: Production of a powdered composition

[0108] Coating means B1 was evaporated in the vacuum at the rotation evaporator up to dry ones and dried with 50 DEG C in the vacuum. The solid became in an analysis mill of the companies IKA (type IKA A10) to a powder grind.

Example 18:

[0109] Similar to example 17 coating means B2 was transferred into a powdered composition.

Example 19:

[0110] An adhesive film became in the powder from example 17 10 seconds. moved. Subsequently, in such a way received foil with compressed air was blown off. On the adhesive foil a thin powder layer clung. The sample was not moistened by the water. The static contact angle for water was > 160 DEG.

Example 20:

[0111] Similar to example 19 an adhesive foil was coated with the powdered composition from example 18. In such a way received coated surface was not moistened by the water. The static contact angle for water was > 160 DEG.

Example 21: Production of the molded article

[0112] The powder from example 17 became into a Formpresse with a pressure of 7,4.10< 7> Pa to a plate with a thickness of 2mm injects. The plate was not moistened by the water. The static contact angle for water was > 160 DEG.

Example 22: Production of a molded article

[0113] Similar to example 21 from the powder from example 18 a thin plate with a thickness was manufactured by 2mm. The static contact angle for water was > 160 DEG.

III application technology investigations**Test of the wettability:**

[0114] The 5, coated foils F1 and F2, the foils of the examples 19 and 20, the glass plate F3 from example 8, the

wooden plate F4 from example 10 and the plates of the examples 21 and 22, described in the examples 3 and, on a measuring table arrangement for the determination of the Reppellent power were attached. With an angle of inclination of 10 DEG successively as drops the following aqueous liquids in defined quantity were applied in each case:

Water (30 mg),
Coffee (30 mg),
Honey (59 mg),
aqueous hydrochloric acid (32 gew. - %ig, 41 mg),
aqueous caustic soda solution (5 gew. - %ig, 45 mg),
30 gew. - %ige solution of Polyacrylsäure in water (47 mg),
30 gew. - %ige solution copolymers from Vinylpyrrolidon and Vinylimidazol in water (35 mg),
aqueous polymer dispersion Acronal TM 290D (BASF corporation, 58 mg),
aqueous polymer dispersion Styronal TM D808 (BASF corporation 46 mg).

[0115] All drops ran off with an angle of inclination of 10 DEG against the horizontal arrears-free from the foil F1, F2, the glass plate F3 and the wooden plate F4.

[0116] In a comparison experiment the liquids specified above were dripped on a not treated PET foil. The angle of inclination of the sample amounted to likewise 10 DEG against the horizontal. In all cases it came to a wetting of the surface; with exception of water all liquids left arrears on the foil.

[0117] In the way described before also the coated glass plates F5, F6 and F7 were examined. For this the following liquids were examined:

Water (30 mg),
Coffee (30 mg),
Honey (59 mg),
aqueous hydrochloric acid (32 gew. - %ig, 41 mg),
aqueous caustic soda solution (5 gew. - %ig, 45 mg),
30 gew. - %ige solution of Polyacrylsäure in water (47 mg),
30 gew. - %ige solution copolymers from Vinylpyrrolidon and Vinylimidazol in water (35 mg).

[0118] With exception of the aqueous Polyacrylsäure and honey all drops ran off arrears-free. Honey and the Polyacrylsäurelösung left small liquid quantities on the surface.

Test of the Schmutzentfernung:

[0119] The foils F1 and F2, the foils of the examples 18 and 19, the glass plates F3 and F6, which became plates of the examples 20 and 21 and the coated wooden plate F4 with soot powder (Printex TM V, BASF of pressure systems GmbH) soiled. Subsequently, one dripped water on the coating. The soot powder was almost completely removed F2 and F3 by the abperlenden water drops in case of of F1, completely, in case of from F4 and F6, so that the original surface became to receive again. A use of cleaning agents was not necessary.

[0120] In a comparison experiment an untreated PET foil with soot powder (Printex TM V, BASF of pressure systems GmbH) was soiled. Subsequently, one dripped water on the foils. The soot powder was only partly removed by the abperlenden water drops, so that soot marks on the foil stayed.

[0121] In addition white paper with the aerosol B6 from example 11 was sprayed and afterwards about 3 min was dried. The sprayed paper was soiled with soot powder (Printex V of BASF of pressure systems GmbH) and washed off afterwards with water. The soot powder was removed by the abperlenden water drops, so that the original clean paper surface became to receive again. After the Abperlen of the water drops the paper was aufgeweicht, but complete drying.

[0122] In a comparison experiment a not sprayed white paper with soot powder was soiled and washed off afterwards with water. The water running off removed the soot only to a small part, so that soot marks on the paper stayed. After running off the water the paper was wet and aufgeweicht.

Test of the lining prevention:

[0123] The coated foil F2 was warmed up to 110 DEG C. On the hot foil one dripped melted Sorbitol (110 DEG C). The Sorbitoltropfen did not moisten the foil. A small angle of inclination of the foil of approximately 5 DEG led to complete, arrears-free running off of the melted Sorbitoltropfen.

[0124] In a further investigation one dripped further melted Sorbitol on the warmed up foil and left then on 20 DEG C cooling. Here the Sorbitoltropfen solidified to sticky resin-like drops, which could be removed by easy affecting with a spatula completely from the foil. No Sorbitolrückstände on the foil was observed.

[0125] In similar way the foil from example 20 and the plate from example 22 was examined. The same results as with were found foil F2.

[0126] To comparison purposes one dripped a Sorbitolschmelze (110 DEG C) on uncoated, 110 DEG C a hot polyethylene terephthalate foil. The Sorbitolschmelze moistened the foil surface and also with an angle of inclination of 90 DEG ran off the melt not arrears-free from the foil. Cooled off Sorbitol (20 DEG C) stuck together with the foil and could not from it mechanically not arrears-free be removed.

Mechanical stability:

[0127] The plates of the examples 20 and 21 were abgeschmirgelt with emery paper (granulation 320), until they had lost 10% of their weight. In such a way received plates pointed a static contact angle for water > 160 DEG up and became also from the liquids specified under III (water, coffee, honey, aqueous HCl, aqueous NaOH, aqueous Polyacrylsäure, aqueous Polyvinylpyrrolidon/Vinylimidazol copolymer, Acronal TM 290 D and Styronal TM D808 not moistened.

Decrease of flow resistance:

[0128] A commercial Kapillarviskosimeter (company Bulkhead, type 50140/IV) with a capillary diameter of 3.6 mm was completely filled with coating means the B3. After 5 minutes the coating means B3 was again filled. Subsequently, one led non-lubricated air for the distance of the solvent about 15 minutes by the capillary. Subsequently, one determined the paper-eject time of Glycerin with 20 DEG C. Them amounted to 55 seconds. The paper-eject time of a mixture from 95 g Glycerin and 5 g water amounted to 24 seconds.

[0129] For comparison purposes in an identically constructed Viskosimeter, which was uncoated, the paper-eject time of the solutions specified above were intended. With Glycerin them amounted to 74 seconds. During the mixture from 95 g Glycerin and 5 g water it amounted to 31 seconds. This corresponds to a decrease of the paper-eject time of 26% in case of the Glycerins and/or. 23% in case of the mixture from Glycerin and water. The examples show clearly that the flow resistance of flowing liquids in pipings is reduced by the coatings according to invention.